CLAIMS

What is claimed is:

1. A system for controlling network congestion, comprising:

a device configured for communicating over a network; and

means for explicitly indicating which packets are being sent back-to-back, and for setting congestion control parameters for a sender in response to estimating network bandwidth based on the receipt of explicit back-to-back packet indications.

2. A system as recited in claim 1, further comprising means for estimating the number of back-to-back packets received within a receiver from a sender and utilizing that information in conjunction with the explicit back-to-back packet information.

3. A system as recited in claim 2, wherein said estimating of back-to-back packets received from a sender comprises determining the amount of data within acknowledgement packets (ACKs) and/or determining whether transmissions were sent back-to-back in response to examining packet timestamps.

4. A system as recited in claim 2, wherein said back-to-back estimates are utilized for checking the presence and validity of explicit back-to-back indications from a sender.

5. A system as recited in claim 2, wherein said back-to-back estimates are utilized when explicit back-to-back packet indications being received from a sender are either not available or appear erroneous.

6. A system as recited in claim 1, wherein said setting of congestion control parameters for a sender regulates packet transmissions by said sender in response to available bandwidth between said sender and the receiver.

7. A system as recited in claim 1, wherein said network operates according to a transport control protocol (TCP).

8. A system as recited in claim 1, wherein said explicit back-to-back packet indications comprise modulating the setting of at least one header bit indicating back-to-back status of packets being transmitted.

9. A system as recited in claim 1, wherein said explicit back-to-back packet indications comprise modulating the setting of the maximum segment size (MSS) for indicating back-to-back status of packets being transmitted.

10. A system as recited in claim 1, further comprising means for the receiver to control packet train size based in response to bandwidth estimations by changing the rate *m* at which receipt acknowledgements (ACKs) are communicated from the receiver to said sender.

11. A system as recited in claim 1, wherein said congestion control parameters comprise a slow start threshold.

12. A system as recited in claim 1, wherein said congestion control parameters comprise a congestion window value.

13. A system as recited in claim 1, wherein said means which explicitly indicates back-to-back packets and sets congestion control parameters comprises:

a computer within said device;

programming within said computer for,

marking packets according to whether or not they are being sent back-to-back,

estimating bandwidth based on receiving packets from a sender which are marked with back-to-back packet indications,

determining congestion control parameters in response to said

congestion estimating,

communicating said congestion control parameters to the sender.

14. A system for controlling network congestion, comprising:

a device configured for communicating over a network;

a processor within said device configured for controlling the sending and receiving of packets over said network; and

programming configured for executing on said processor for,

marking packets to explicitly indicate if they are sent back-to-back,

estimating network bandwidth in response to receipt of said explicit indications of back-to-back packets,

establishing congestion control parameters in response to said network bandwidth estimates.

15. A system as recited in claim 14, wherein said network communications are performed according to a transport control protocol (TCP).

16. A system as recited in claim 14, wherein bits in the header are used for marking packets with explicit back-to-back packet sending indications.

17. A system as recited in claim 16, wherein said header bits comprise unreserved bits according to the transport control protocol (TCP) standard.

18. A system as recited in claim 14, wherein maximum segment size (MSS) is modified for marking packets with explicit back-to-back packet sending indications.

19. A system as recited in claim 18, wherein the size of packets being sent is modulated in response to whether or not the packets are sent back-to-back.

20. A system as recited in claim 19, wherein said size of packets being sent is reduced from the maximum segment size (MSS) value according to a

predetermined number of bits for indicating whether the packets are being sent back-to-back.

21. A system as recited in claim 20, wherein said predetermined number of bits can be 1, 2 or 4 bits.

22. A system as recited in claim 14, wherein said congestion control parameters comprise a slow start threshold.

23. A system as recited in claim 14, wherein said congestion control parameters comprise a congestion window value.

24. A system as recited in claim 14, further comprising programming for controlling the length of packet trains transmitted by a sender in response to modifying the rate at which receipt acknowledgements (ACKs) are communicated from the receiver to said sender.

25. A system as recited in claim 14, wherein said marking of packets is performed for every packet sent or performed in response to congestion.

26. A system for controlling network congestion, comprising:

a device configured for communicating over a network;

a processor within said device configured for controlling the sending and receiving of packets over said network; and

programming configured for executing on said processor for,

estimating network bandwidth in response to receipt of explicit indications of back-to-back packets or utilizing back-to-back packet estimations,

controlling the length of packet trains transmitted by the sender in response to altering the rate at which receipt acknowledgements (ACKs) are communicated from the receiver to said sender as based on estimated network bandwidth.

27. A method of using bandwidth estimation to improve transport control protocol (TCP) congestion control within a packet based network, comprising:

marking each packet, explicitly, that is being sent back-to-back to a receiver;

estimating bandwidth in response to receiving from other senders packets explicitly marked as back-to-back packets; and

communicating congestion control parameters to a sender in response to said bandwidth estimates.

28. A method as recited in claim 27, further comprising:

estimating the number of packets being received back-to-back; and

utilizing said packet number estimates in conjunction with the explicit back-to-back packet indications when estimating bandwidth.

29. A method as recited in claim 28, wherein said estimating of back-to-back packets received from a sender comprises estimating the amount of data in acknowledgement packets (ACKs) and/or estimating whether transmissions were sent back-to-back in response to examining a packet timestamp.

30. A method as recited in claim 28, wherein said back-to-back estimates are utilized for checking the presence and validity of explicit back-to-back indications from a sender.

31. A method as recited in claim 28, wherein said back-to-back estimates are utilized when explicit back-to-back packet indications being received from a sender are either not available or appear erroneous.

32. A method as recited in claim 27, wherein said explicit back-to-back packet indications comprise modulating the setting of at least one header bit indicating back-to-back status of packets being transmitted.

33. A method as recited in claim 27, wherein said explicit back-to-back packet indications comprise changing the size of packets being sent from the maximum segment size (MSS) value for indicating whether or not packets are being sent back-to-back.

34. A method as recited in claim 27, wherein said changing of the size of packets being sent is based on reducing the number of bits in a packet from the maximum segment size (MSS) by a predetermined number of bits.

35. A method as recited in claim 34, wherein said predetermined number of bits can be 1, 2 or 4 bits.

36. A method as recited in claim 27, further comprising controlling the length of packet trains transmitted by a sender in response to modifying the rate at which receipt acknowledgements (ACKs) are communicated from a receiver.

37. A method as recited in claim 36, wherein said modifying of the rate at which receipt acknowledgements (ACKs) are communicated comprises establishing a predetermined number of packets receptions before packet acknowledgement.

38. A method as recited in claim 27, wherein said congestion control parameters comprise a slow start threshold.

39. A method as recited in claim 27, wherein said congestion control parameters comprise a congestion window value.